Propagation techniques on root turion sprout browse of *Populus davidiana* Dode

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Abstract: The root segments selected from dominant trees of *Populus davidiana* Dode were taken as reproductive material and were buried in different depths to carry out the reproduction of root turion sprout. The affecting factors of germination rate, survival rate, and height growth for cutting wood of root sprout were comparatively analyzed. The results showed that the best suitable substrate for burying root is pearlite, with a germination rate of 15.16%. 3-4-cm root segments has the highest rate of germination (12.4%). The mixture of sand and soil (2:1) is the best cutting substrate, with a survival rate of 81.3%, while as to height growth of cutting wood, the mixture of turfy and soil (1:1) is the best. The cutting woods selected from different positions of stem show difference in height growth. The cutting wood from top stem is higher obviously than those from middle or low stem.

Key words: *Populus davidiana Dode*; Root turion; Cutting
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Material and method

The root segments were selected from 10 dominant trees of *Populus davidiana* Dode in May, with length of 1-4 cm, and set in the plastic box (cultivating seedling panel) after washed and brushed. Sand, pearlite and turfy, mixed in different proportion, were used as substrate (Liu 1991). The roots were buried in different depths, and the best depth is that we can only see the root epidermis. The root segments were divided into 3 scales by diameter: I--1-2 cm, II--2-3 cm and III--3-4 cm. The root segments were watered at regular intervals (Liu 1993).

Three hormones--IBA, NAA, and ABT were used in order to improve survival rate, which was mixed in the concentrations of 200 mg/kg, 300 mg/kg and 400 mg/kg respectively. The root segments were socked in those three hormones for 10 min, 30 min and 60 min. Thus totally 27 combinations were formed (Liu 1988).

The cutting substrate for the experiment is as follows

Disposal	Substrate composition	Proportion
1	sand : soil	2:1
2	pearlite : soil	2:1
3	pearlite : turfy : soil	1:1:1
4	turfy	1
5	turfy : soil	1:1

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The temperature in greenhouse was controlled at 20-25 ℃, 1-minute artificial spray was done in every 3 min to keep the leaf damp. After two weeks, the times of spray were decreased.

Results

The effect of root segments diameter and different substrates on survival rate of turioniferous sprout

The root segments began to sprout after buried 7-10 days. The number of turioniferous sprout may depend on the size of root segments diameter (see Table 1). The experimental results show that the germination rate of sprout is 12.4%, 6.71% and 5.72% for diameters of root segments 3-4 cm, 2-3 cm and 2 cm, respectively. As to substrates, pearlite is the best substrate, with a germination rate of 15.16%.

The effect of different substrates on cutting survival rate and growth of turioniferous sprout

The height growth and survival rate of root sprout were investigated for the cutting experiment of 5 different substrates after burring one month, 20 samples for each kind of substrate and 3 repeats. The cutting wood is the top of turioniferous sprout and the length is 4 cm (see Table 2).

The result of variance analysis showed that the effect of different substrates on cutting survival rate was extremely significant, and the LSR test is further done (Table 3).

The result showed that the best substrate was the mixture of sand and soil with the proportion of 2-sand : 1-soil, with a survival rate of 81.3%.

Table 1. The effect of root segments' diameters and different substrates on survival rate and germination rate of turioniferous sprout.

No.	Diameter grade	Substrate	Quantity /m	Total number	Survival number	Survival rate /%	Mortality	Germination rate (number of tree /m)
1	I	6s3±1s	152.5	1889	1818	96.24	71	12.4
2	II	6s3±1s	216	1450	1297	89.4	153	6.71
3	II	6s3±1s	360	2062	1687	1.81	375	5.72
4	III	6s3±1s	30	189	160	84.7	29	6.30
5	II	10s	18	134	116	86.7	18	7.44
6	II	10p	6	91	89	97.8	2	15.16
7	II	3s1t (mixed)	6	48	48	100	0	8.00
8	II	3s1t (mixed)	12	15	12	80	3	1.25
9	SII	6s3±1s	12	15	12	80	3	1.25
10	SII	6s3±1s	17	31	29	93.5	2	1.82
11	SII	6s3±1s	18	47	39	83.0	8	2.61
12	SII	6s3±1s	12	92	87	94.7	5	7.66
13	SII	6s3±1s	12	28	28	100	0	2.33
14	SII	6s3±1s	12	14	13	92.9	1	1.16
15	SII	6s3±1s	19	76	68	89.5	8	4.00
16	SII	6s3±1s	23	83	74	81.6	9	3.60
17	SII	6s3±1s	15	38	36	94.7	2	2.53
18	SII	6s3±1s	12	15	15	100	0	1.25

Note: SII——Superior II, 6s3±1s——6 sand 3±1 sand, 3s1t——3 sand and 1turfy

Table 2. The variance analysis of effect of different substrates on cutting survival rate.

Source of variation	Freedom	Sum of squares	Variance	*F* value	$F_{0.05}$
Disposal	4	4139.70	1034.92	15.69	2.74
Plot	2	761.69	380.84		
Error	8	527.38	65.92		
Total variation	14	5428.78			

Table 3. The LSR test of effect of different substrates on cutting survival rate.

No	*X*
1	81.3
3	71.6
5	64.7
2	64.5
4	31.47

Table 4. The variance analysis about different substrates and height growth.

Source of variation	Freedom	Sum of squares	Variance	*F* value	$F_{0.05}$
Disposal	4	144.43	36.10	19.15**	3.069
Plot	2	0.3375	0.4437		
Error	8	15.67	1.88		
Total variation	14	160.40			

The variance analysis showed that the effect of different substrates on height growth of cutting seedling was extremely significant level (see Table 4), and the LSR test see Table 5.

The result showed that the best substrate was the disposal 5 (turfy : soil is 1 : 1), and the height growth was 17.25 cm.

Table 5. The LSR test of effect of different substrates on height growth

No.	*X*
5	17.25
4	15.86
2	12.01
3	11.03
1	8.86

Effect of different positions in turioniferous sprout on survival rate and height growth

The cutting wood was selected from top, middle or low stem respectively, with a length of 4 cm, and put in the substrate of mixed sand and soil (2:1) (see Table 6).

Table 6. The effect of different positions in turioniferous sprout on survival rate and height growth

Position	Number of cutting wood	Survival quantity	Survival rate /%	Height growth in 22 d	Height growth in 32 d
Top	264	246	93.2	4.86	8.82
Middle or low	264	251	95.45	2.96	5.46

The result shows that the cutting survival rate is not significant difference between the cutting woods from top stem and those from the middle or low stem. The cutting woods from different positions of stem have significant

difference in height growth. The cutting woods from top stem are 1.90 cm and 3.36 cm respectively in the growth periods of 22 days and 32 days higher than those from middle or low stem.

Conclusion

The diameter size of root segments and different substrates of burying root have effect for the number of turioniferous sprout. The best diameter is 3-4 cm, which the rate of germination is the highest (12.4%). The best substrate of burying root is pearlite, and the rate of germination is about 15.16%.

The different substrates have effect on survival rate and height growth. The best cutting substrate for height growth is the mixture of turfy and soil (1:1), and the height growth is 17.25 cm. As to survival rate, the mixture of sand and soil (2:1) is the best substrate, which is up 81.3%.

The cutting woods selected from different positions of stem show difference in height growth. The cutting wood from top stem is higher obviously than those from middle or low stem.

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